

CLAIMS

What is claimed is:

1. A method of managing incoming data for a dormant mobile terminal at a packet control function (PCF) in a wireless communication network, the method comprising:

5 receiving incoming data from a public data network (PDN) for the dormant mobile terminal at the PCF;

starting a timer responsive to receiving the incoming data;

initiating connection establishment between the dormant mobile terminal and the PCF responsive to the incoming data;

10 buffering the received incoming data;

transferring the buffered incoming data from the PCF to the previously dormant mobile terminal if the connection is established before expiration of the timer; and

15 discarding the buffered incoming data if the connection between the dormant mobile terminal and the PCF is not established before expiration of the timer.

2. The method of claim 1 wherein buffering the received incoming data comprises buffering incoming data for the dormant mobile terminal up to a defined buffer limit.

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3. The method of claim 2 further comprising continuing to buffer incoming data for the dormant mobile terminal received after starting the timer up to the defined buffer limit.

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4. The method of claim 2 further comprising buffering at least a portion of incoming data for the mobile terminal received after starting the timer, such that incoming data for

the dormant mobile terminal received before expiration of the timer is buffered up to the defined buffer limit.

5. The method of claim 2 further comprising implementing the defined buffer limit as
5 a configurable buffer limit.

6. The method of claim 2 further comprising discarding incoming data on a last-in basis to avoid exceeding the defined buffer limit.

10 7. The method of claim 1 further comprising discarding data on a first-in basis to avoid exceeding the defined buffer limit.

8. The method of claim 1 further comprising managing incoming data for a plurality of dormant mobile terminals.

15 9. A method of managing incoming data for a dormant mobile terminal, wherein a packet control function (PCF) receives the data from a packet data serving node (PDSN) in a wireless communication network, the method comprising:

20 receiving incoming data for the dormant mobile terminal from the PDSN
at the PCF;
starting a timer responsive to receiving the data;
initiating connection reestablishment with the dormant mobile terminal responsive
to receiving the data;
buffering the incoming data up to a defined buffer limit;
25 discarding any incoming data received after reaching the defined buffer limit;

transferring buffered data from the PCF to the previously dormant mobile

terminal if a connection with the mobile terminal is reestablished before

expiration of the timer; and

discarding the buffered data and resetting the timer if the connection with the

5 mobile terminal is not reestablished before expiration of the timer.

10. The method of claim 9 further comprising configuring an expiration period of the timer to match an expected reactivation delay of the mobile terminal.

10 11. The method of claim 10 further comprising determining said expected reactivation delay based on an average expected time associated with said connection reestablishment.

12. The method of claim 9 further comprising setting the defined buffer limit to a
15 value that accommodates an expected maximum data packet size.

13. The method of 9 further comprising setting the defined buffer limit according to a TCP window size.

20 14. The method of claim 9 further comprising repeating the steps of claim 1 after expiration of the timer if the mobile terminal remains dormant and subsequent data is received for the mobile terminal.

15. The method of claim 9 further comprising buffering incoming data for a plurality of
25 dormant mobile terminals.

16. The method of claim 15 further comprising timing connection reestablishment for individual ones of said plurality of mobile terminals.

17. The method of claim 9 wherein initiating connection reestablishment with the dormant mobile terminal responsive to receiving the data comprises generating a service request message for a base station controller (BSC) associated with said mobile terminal.

18. The method of claim 9 wherein transferring buffered data from the PCF to the previously dormant mobile terminal comprises transferring the buffered data to a base station controller (BSC) associated with said mobile terminal.

19. A method of managing data for dormant mobile terminals within a wireless communication network, the method comprising:

receiving data for a dormant mobile terminal from a packet data serving node (PDSN) at a packet control function (PCF);

starting a timer at said PCF responsive to receiving the data;

buffering incoming data received at the PCF for the dormant mobile terminal;

initiating re-establishment of an active connection with the dormant mobile

terminal by sending a service request from said PCF to a base station controller (BSC) associated with said dormant mobile terminal;

sending a service request from said BSC to a mobile station controller (MSC) responsive receiving the service request from said PCF;;

paging the dormant mobile terminal from said MSC via said BSC responsive to receiving the service request from said BSC;

setting up a traffic channel between said BSC and said mobile terminal if the
previously dormant mobile terminal responds to said paging request; and
transferring the buffered data from said PCF to said mobile terminal via said BSC
if said traffic channel is established before expiration of the timer;
5 discarding the buffered data at said PCF if said traffic channel is not established
before expiration of the timer; and
resetting the timer upon transferring the buffered data or upon expiration of
the timer.

10 20. The method of claim 19 further comprising discarding at least a portion of the
incoming data received for the dormant mobile terminal before expiration of the timer if
an amount of incoming data received exceeds a defined buffer limit.

15 21. The method of claim 19 further comprising setting said defined buffer limit to a
value matching an expected maximum packet data size.

22. The method of claim 19 further comprising paging the mobile terminal again if
subsequent data is received for the dormant mobile terminal and the timer has been
reset.

20 23. The method of claim 19 further comprising performing the steps of claim 1 for a
plurality of dormant mobile terminals, wherein said PCF buffers data received for each
one of said plurality of dormant mobile terminals.

25 24. The method of claim 19 further comprising basing signaling between said PCF,
BSC, and MSC, on signaling standards defined for the wireless communication network.

25. The method of claim 24 wherein the wireless communication network is based on the TIA/EIA/IS-2000 standard, and further comprising said signaling based on the IOS v4.0 signaling standards.

5 26. The method of claim 19 further comprising setting the expiration period of the timer to be approximately thirty seconds.

27. The method of claim 19 further comprising setting the defined buffer limit to be approximately sixty-four kilobytes.

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28. The method of claim 19 further comprising maintaining a buffer and a timer for each dormant mobile terminal for which data is received at said PCF.

29. A packet control function (PCF) for use in a wireless communication network, the
15 PCF comprising:

at least one processor, wherein the at least one processor starts a timer and initiates connection re-establishment between the PCF and a dormant mobile terminal associated with the PCF in response to the PCF receiving incoming data for the dormant mobile terminal; and

20 memory, wherein the PCF buffers the received incoming data in the memory; and

wherein the PCF discards the buffered incoming data from the memory if the connection cannot be re-established before the timer has expired or transfers the buffered incoming data to the mobile terminal if the
25 connection is re-established before the timer has expired.

30. The PCF of claim 29, wherein the PCF buffers the incoming data in the memory up to a defined buffer limit.

31. The PCF of claim 30, wherein the PCF continues buffering at least a portion of incoming data received after starting the timer up to the defined buffer limit.

32. The PCF of claim 30, wherein the PCF discards incoming data received in excess of the defined buffer limit.

33. The PCF of claim 30, wherein the PCF discards incoming data on a first-in basis to avoid exceeding the defined buffer limit.

34. The PCF of claim 30, wherein the PCF discards incoming data on a last-in basis to avoid exceeding the defined buffer limit.

35. The PCF of claim 30, wherein the PCF uses a configurable buffer limit as the defined buffer limit.

36. The PCF of claim 29, wherein the PCF maintains a timer and a corresponding buffer for each of a plurality of dormant mobile terminals.

37. The PCF of claim 29, wherein the PCF communicates with an originating network entity if buffered incoming data is discarded, such that the originating network entity re-transmits at least a portion of the discarded data.

38. The PCF of claim 29, wherein the incoming data comprises packet data, and wherein the PCF buffers incoming packets up to a defined buffer limit, and transfers buffered packet data to the previously dormant mobile terminal in the order that the packet data was received at the PCF.

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39. A packet control function (PCF) for use in a wireless communication network, the PCF comprising memory and at least one processor, said at least one processor adapted to:

start a timer responsive to receiving incoming data for a dormant mobile terminal

associated with said PCF;

buffer the incoming data in said memory up to a defined buffer limit;

initiate connection reestablishment with the dormant mobile terminal responsive to the incoming data;

transfer buffered data from the PCF to the previously dormant mobile terminal if a

connection with the mobile terminal is reestablished before expiration of the timer; and

discard the buffered data and reset the timer if the connection with the mobile terminal is not reestablished before expiration of the timer.

40. The PCF of claim 39 wherein said at least one processor buffers incoming data for a plurality of dormant mobile terminals.

41. The PCF of claim 40 wherein said at least one processor maintains a separate buffer in said memory for buffering incoming data for each of said plurality of dormant mobile terminals that receives incoming data while dormant.

42. The PCF of claim 40 wherein said at least one processor maintains a separate timer for timing connection reestablishment of each of said plurality of dormant mobile terminals that receives incoming data.

5 43. The PCF of claim 39 wherein the timer has an expiration period matched to an expected maximum time for reestablishing connection with the mobile terminal.

44. The PCF of claim 39 wherein said at least one processor buffers the incoming data in said memory up to a defined buffer limit by discarding any incoming data
10 received before expiration of the timer and in excess of said defined buffer limit.

45. The PCF of claim 39 wherein said at least one processor initiates connection reestablishment with the dormant mobile terminal responsive to the incoming data by sending a service request message to a base station controller (BSC) associated with
15 the dormant mobile terminal.

46. The PCF of claim 45 wherein the wireless communication network is based on the TIA/EIA/IS-2000 standards, and wherein the processor sends said service request to the BSC by generating an A9 base station service request.

20 47. The PCF of claim 45 wherein said processor receives the incoming data through an A10 connection established between said PCF and a packet data serving node (PDSN).

48. The PCF of claim 39 wherein said processor transfers buffered data from the PCF to the previously dormant mobile terminal by transferring the buffered data to a base station controller associated with the previously dormant mobile terminal.

5 49. The PCF of claim 39 wherein said processor receives a setup request message from a base station controller associated with said PCF as indication that the connection was reestablished with the previously dormant mobile terminal.